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Outbreak Investigation

Adenovirus Type 4 Outbreak among Basic Trainees at Ft. Benning, Georgia, April-May 2000

Between 27and 28 April 2000, 127 basic trainees at Fort Benning, Georgia, were admitted to Martin Army Community Hospital (MACH) with febrile upper respiratory illnesses. One hundred twelve (88%) of them were from a single training company. More than half (54%) of the trainees of the most affected company were hospitalized. Although all hospitalized trainees had been immunized against influenza, rapid diagnostic tests for influenza A/B were positive in 29 of 31 soldiers initially tested. To accommodate the exceptionally heavy patient load, an infirmary was established in the barracks that normally housed the most severely affected company.

On 28 April 2000, at the request of the hospital commander, an epidemiologic consultation (EPICON) team composed of members from the US Army Center for Health Promotion and Preventive Medicine (USACHPPM), the Walter Reed Army Institute of Research (WRAIR), and MACH began an investigation to determine the cause of the outbreak and to recommend control measures.

Methods. For purposes of the investigation, a febrile upper respiratory illness case was defined as a basic trainee from the Sand Hill Area of Fort Benning with an outpatient visit or a hospital admission between 23 April and 6 May 2000 who complained of upper respiratory symptoms and had a documented oral temperature greater than or equal to 100.4°F.

In coordination with the MACH Preventive Medicine Service, throat swabs for viral cultures were obtained from 42 hospitalized soldiers and sent to the Naval Health Research Center, San Diego, California. Fifty-four hospitalized soldiers provided "acute" serum samples, and 40 provided convalescent specimens approximately 30 days later. Serologic tests were done at WRAIR and the Centers for Disease Control and Prevention (CDC), Atlanta, Georgia.

Dates of admission, demographic characteristics, upper respiratory and other symptoms, maximum recorded temperatures, and laboratory results were extracted from the inpatient records of 109 hospitalized patients. Immunization records at the reception station, which administers vaccines to all new trainees, were reviewed. In addition, the MACH Industrial Hygiene section performed surveys of the barracks of the most affected units. Specifically, while the trainees were sleeping, ambient CO_2 lev-

Continued on page 7

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Figure 1. Hospitalization rate, febrile acute respiratory diseases, trainees at Fort Benning, Georgia, July 1999 - June 2000

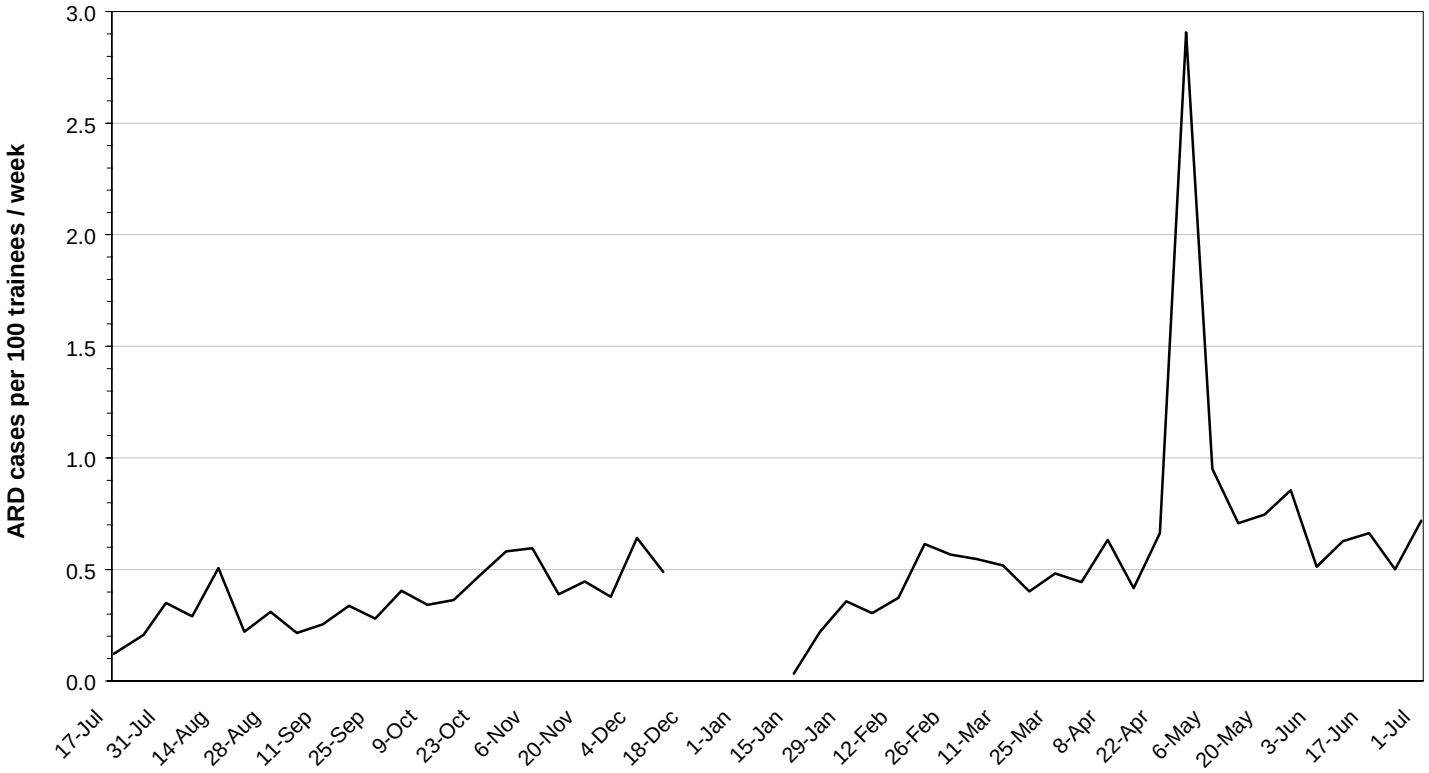


Figure 2. Hospitalizations for febrile upper respiratory illnesses, basic trainees from Sand Hill Area, Fort Benning, Georgia, 23 April - 6 May 2000

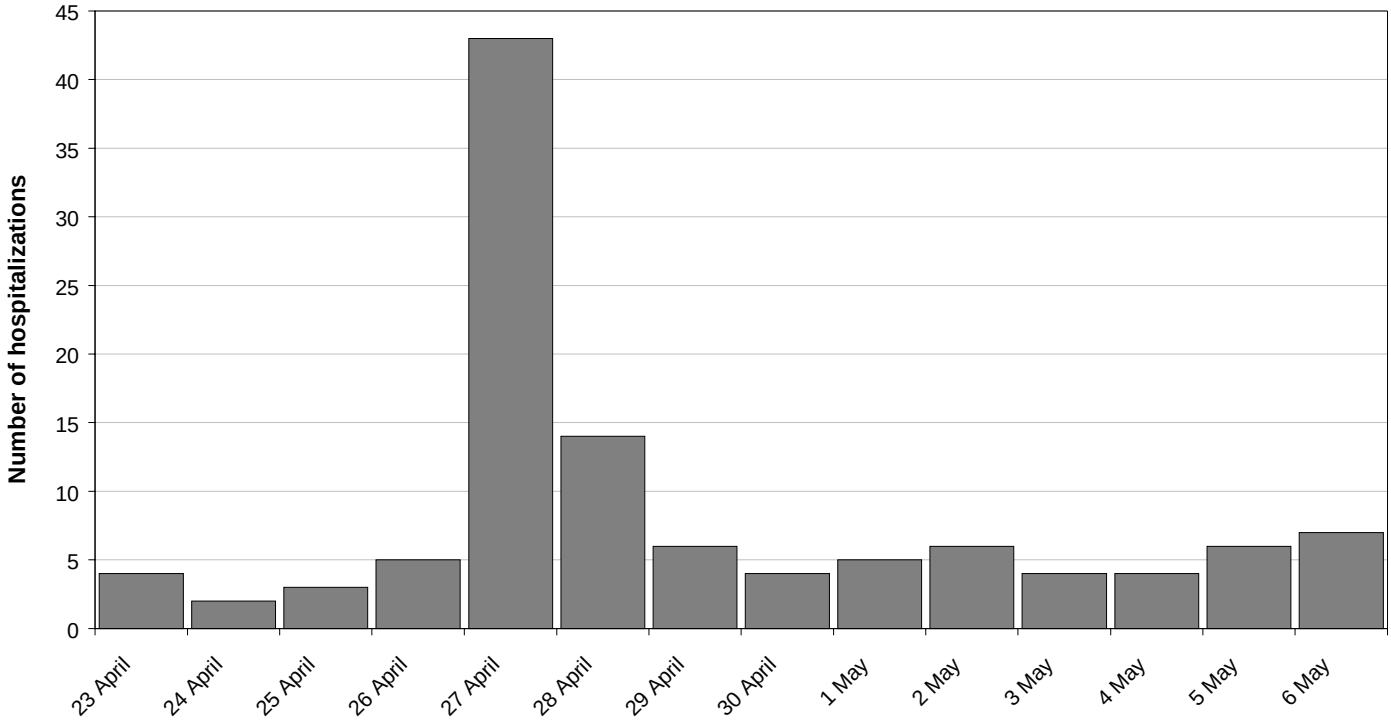


Table I. Sentinel reportable events, US Army medical treatment facilities[1] Cumulative events for all beneficiaries, calendar year through June 30, 1999 and 2000[2]

Reporting Facility	Number of reported events[3]		Environmental				Food- and Water-borne							
			Cold		Heat		Campylobacter		Giardia		Salmonella		Shigella	
	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000
NORTH ATLANTIC RMC														
Walter Reed AMC, DC	100	99	-	-	-	-	3	-	4	5	-	5	-	2
Aberdeen Prov. Grd., MD	23	9	-	-	-	-	-	-	-	-	-	-	-	-
FT Belvoir, VA	104	105	-	-	-	4	3	7	4	1	5	3	1	-
FT Bragg, NC	522	678	8	-	27	72	3	-	2	-	1-	5	-	-
FT Drum, NY	125	129	15	9	3	1	1	-	2	-	-	-	-	-
FT Eustis, VA	111	117	1	-	-	5	-	4	-	-	4	-	-	-
FT Knox, KY	126	118	1	-	-	7	-	-	-	-	1	1	-	-
FT Lee, VA	90	133	-	-	-	-	-	-	-	-	-	-	-	-
FT Meade, MD	48	43	-	-	-	-	-	-	-	-	-	1	-	-
West Point, NY	19	44	-	1	-	-	-	-	-	-	-	3	-	-
GREAT PLAINS RMC														
Beaumont AMC, TX	127	164	-	-	3	6	-	-	-	-	1	6	-	1
Brooke AMC, TX	233	165	-	-	-	1	-	-	-	2	2	3	4	5
FT Carson, CO	378	327	2	-	-	-	3	-	4	-	4	1	-	1
FT Hood, TX	426	848	-	1	1	9	-	1	1	-	1	-	1	2
FT Huachuca, AZ	27	23	-	-	-	1	-	-	-	-	-	-	-	-
FT Leavenworth, KS	-	10	-	-	-	-	-	-	-	1	-	1	-	-
FT Leonard Wood, MO	86	79	3	3	2	3	-	-	-	-	1	-	-	-
FT Polk, LA	120	138	-	-	-	-	-	-	-	-	-	-	-	-
FT Riley, KS	168	138	1	22	-	1	-	-	-	-	-	-	-	-
FT Sill, OK	144	133	-	-	1	-	-	-	-	-	-	-	-	-
SOUTHEAST RMC														
Eisenhower AMC, GA	113	106	1	-	2	-	-	-	-	-	-	-	-	-
FT Benning, GA	175	158	-	-	24	24	1	-	1	1	5	3	2	-
FT Campbell, KY	288	234	2	2	2	-	11	-	1	2	9	4	53	10
FT Jackson, SC	193	266	-	-	-	-	-	-	-	1	-	-	-	-
FT Rucker, AL	27	40	-	-	1	-	-	-	-	-	-	1	-	-
FT Stewart, GA	165	262	-	-	1	8	-	-	-	-	1	1	-	-
WESTERN RMC														
Madigan AMC, WA	332	368	-	-	-	-	2	3	4	1	5	-	1	1
FT Irwin, CA	20	34	-	-	-	-	-	-	-	-	-	-	-	-
FT Wainwright, AK	83	41	42	4	-	-	-	-	-	-	-	-	-	-
OTHER LOCATIONS														
Tripler, HI	207	383	-	-	-	1	5	17	5	6	3	3	1	-
Europe	246	846	3	5	-	-	6	9	-	1	3	14	1	-
Korea	204	257	8	2	-	-	-	-	-	-	-	1	-	-
Total	**5,030**	**6,495**	**87**	**49**	**67**	**143**	**38**	**41**	**28**	**21**	**55**	**56**	**64**	**22**

1. Main and satellite clinics.
2. Events reported by July 7, 1999 and 2000.
3. Tri-Service Reportable Events, Version 1.0, July 1999.

Table I. (Cont'd) Sentinel reportable events, US Army medical treatment facilities[1] Cumulative events for all beneficiaries, calendar year through June 30, 1999 and 2000[2]

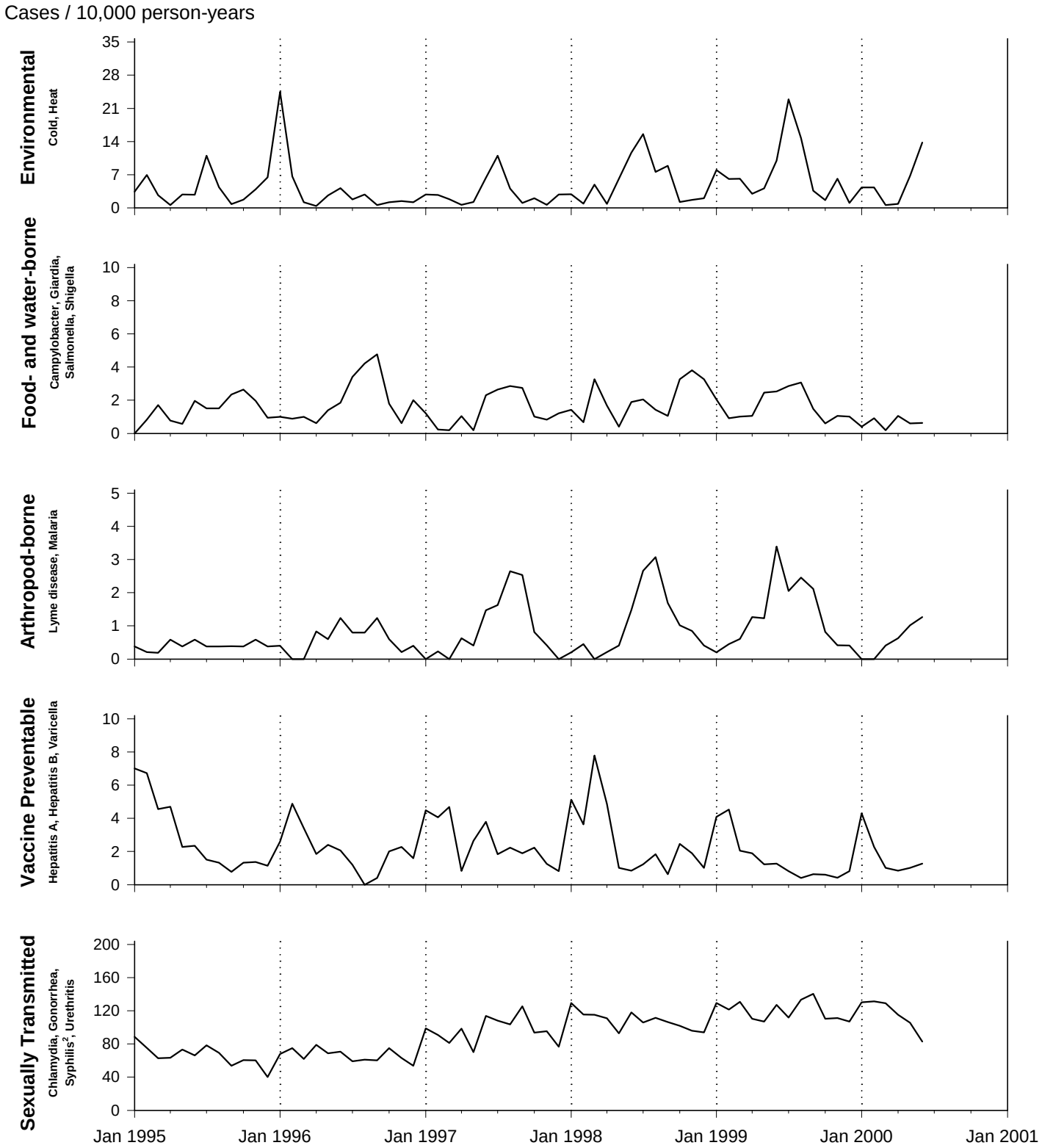
Arthropod-borne				Vaccine Preventable						Sexually Transmitted							
Lyme Disease		Malaria		Hepatitis A		Hepatitis B		Varicella		Chlamydia		Gonorrhea		Syphilis[4]		Urethritis	
Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000	Cum. 1999	Cum. 2000
1	2	1	-	1	1	-	1	2	2	45	28	8	14	3	1	1	-
-	1	-	-	-	-	-	-	1	-	8	4	12	0	-	2	2	-
-	-	-	-	1	-	-	3	-	1	63	69	26	9	-	2	0	-
1	1	3	2	-	-	-	-	1	3	260	261	125	139	-	1	81	193
-	-	2	-	-	-	-	-	6	5	59	80	33	31	-	-	3	2
-	1	-	-	-	-	1	1	1	1	81	84	21	17	-	-	-	-
-	-	-	-	-	-	-	1	1	4	91	79	31	24	-	1	-	-
-	-	-	-	-	-	-	-	-	-	70	109	18	24	2	-	-	-
2	-	-	-	-	-	-	-	1	-	39	30	4	6	-	-	-	1
7	5	-	-	-	-	-	-	1	2	10	25	1	7	-	-	-	-
-	-	1	-	-	2	-	-	2	1	98	121	10	19	-	-	8	3
-	-	-	1	2	-	3	-	2	2	75	87	27	27	-	2	1	-
-	-	-	1	-	-	1	-	1	-	273	263	43	40	-	-	44	20
-	-	2	-	-	-	1	1	2	2	260	472	80	168	3	-	66	171
-	-	-	-	1	-	-	-	-	-	24	16	2	6	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	5	-	1	-	-	-	-
-	-	-	-	-	-	1	-	8	12	46	37	14	18	1	0	7	6
-	-	-	-	-	-	-	-	-	-	100	124	16	14	2	-	-	-
-	-	-	-	-	-	-	-	-	-	124	78	43	36	-	1	-	-
-	1	-	-	-	-	6	-	6	3	74	86	34	19	-	-	19	16
-	-	-	3	-	-	2	1	1	1	92	90	9	8	-	-	-	-
-	-	-	1	1	-	-	-	1	6	67	78	48	39	1	3	-	-
1	-	3	3	-	-	-	-	1	2	141	120	64	85	0	1	-	-
-	-	-	-	-	-	-	-	4	3	145	234	33	27	4	-	-	-
-	-	-	-	-	-	-	-	-	-	19	29	7	10	-	-	-	-
-	-	1	-	-	-	-	-	4	-	50	99	40	58	-	-	68	94
-	-	1	1	1	-	-	1	-	-	212	237	45	31	1	-	53	78
-	-	-	-	-	-	2	-	-	1	15	28	3	5	-	-	-	-
-	-	1	-	-	-	1	-	2	-	30	36	5	1	-	-	-	-
-	-	1	2	-	1	-	2	-	1	120	259	34	44	-	-	-	-
-	5	1	-	-	-	2	6	1	9	185	638	32	145	-	1	1	1
-	-	7	1	-	-	14	1	-	1	140	212	7	15	13	10	-	6
12	**16**	**24**	**15**	**7**	**4**	**34**	**18**	**49**	**62**	**3,016**	**4,118**	**875**	**1,087**	**30**	**25**	**354**	**591**

4. Primary and Secondary.

Note: Completeness and timeliness of reporting varies by facility.

Source: Army Reportable Medical System.

Figure I. Sentinel reportable events (grouped), active duty soldiers, January 1995 - July 2000[1]



1. Events reported by July 7, 2000
2. Primary and Secondary

Source: Army Reportable Medical Events System

Continued from 3

els, temperatures, and humidity levels were recorded in each sleeping bay.

To elucidate the etiology and exacerbating factors in the outbreak, a case-control study was conducted. Members of the most affected company and a 50% random sample (using the terminal digit of the social security number) of a less-affected company in the same battalion were included. A questionnaire was administered to all enrolled subjects to elicit demographic and environmental exposure information (e.g., availability of hand soap in latrines), and training, medical, and smoking histories. Outpatient medical records of study subjects were reviewed, and relevant clinical and immunization data were abstracted. Multivariate logistic regression techniques were used to estimate the strengths of associations between potential risk factors and case status while controlling for the effects of other factors.

Results. Among Fort Benning trainees overall, the hospitalization rate for febrile acute respiratory illnesses peaked at 2.4% for the week ending 29 April 2000, a marked increase over recent and historical baselines (figure 1, page 3 and figure II, page 13). The epidemic curve documented the outbreak's rapid onset, its short duration, and the absence of secondary or propagated waves of transmission (figure 2, page 3).

Of the 109 trainees who met the case definition, 97% complained of fever, 84% of cough, 81% of sore throat, 67% of headache, 65% of myalgia, and 63% of rhinitis. Only seven (7.3%) of 96 bacterial throat cultures were positive. Neither leukocytosis nor leukopenia were distinctive clinical features.

The barracks survey revealed that 18 of 20 air handlers were not operating at the time of the outbreak. Immunization records documented that all influenza vaccinations that were given to cases in the reception station were from a single manufacturer's lot. Vaccine from the lot had been given to trainees in both heavily affected and unaffected training units; in addition, it had been used for several weeks before it was given to trainees who became cases. A vial of the vaccine was reserved for further testing, if needed.

The case-control study included 288 basic trainees, all males, of whom 51 (18%) were cases. In univariate analyses, the following variables were statistically associated with being a case: younger age (mean age, cases: 19.7 years, noncases: 20.9 years, p=0.007); lack of mechanical ventilation in sleeping bay (100% of cases, 92% of controls; p=0.048); temperature in bay >= 72 F. (OR=8.3, 95% CI=1.1, 61.9); sleeping density >=50 per bay (OR=6.3, 95% CI=2.2, 18.3); assignment to D company (OR=5.7, 95% CI=2.0, 16.3); white race (OR= 3.7, 95% CI=1.4, 9.6); influenza vaccination after 26 March 2000 (OR=2.8, 95% CI=1.3, 5.8); history of asthma (OR=2.7, 95% CI=1.1, 6.7); arrival at Ft. Benning before 19 March 2000 (OR=2.6, 95% CI=1.3, 5.2); history of smoking (OR=2.4, 95% CI=1.3, 4.7); and week of training (chi square=13.09, p=0.001). Rank, humidity and carbon dioxide levels in sleeping bays and the availability of soap or hot water in barracks' latrines were not significantly associated with case status.

Since no cases slept in bays with operating air handlers, mechanical ventilation was not included in multivariate analyses. Of factors that were included, younger age (OR=0.82, 95% CI=0.71, 0.95); sleeping density greater than 50 per bay (OR=5.44, 95% CI=1.50, 19.77); and white race (OR=5.3, 95% CI=1.15, 24.17) were significant independent correlates of case status.

Of 47 viral cultures, 43 (91.5%) yielded adenoviruses, and none yielded influenza. All adenovirus isolates that were typed were adenovirus type 4. Of 40 serum pairs that were tested, all revealed either preexisting antibodies or elevated convalescent versus acute phase titers to adenovirus type 4. In contrast, only one serum pair revealed a significant rise in antibodies to influenza (B/Yamanashi/166/98). Finally, serologic tests documented adequate immunologic responses to the 1999-2000 influenza vaccine. In summary, the laboratory data strongly implicated adenovirus type 4 as the etiologic agent of the outbreak.

Editorial comment. This outbreak highlights four potentially modifiable risk factors for acute respiratory diseases among military trainees: immunologic susceptibility to pathogens with known epidemic potential (i.e., adenovirus type 4), barracks ventilation, troop living space, and unit cohorting.

Prior to the development of effective vaccines against adenovirus types 4 and 7, it was estimated that adenoviruses caused a majority of cases—and many large outbreaks—of febrile acute respiratory disease among U.S. military trainees.[1-3] Beginning in 1971, vaccines against adenovirus types 4 and 7 were administered to all new recruits during fall and winter months.[4] In 1984, in response to spring-summer outbreaks, training centers began to administer adenovirus vaccines year-round. For the next 10 years, there were no documented adenovirus-associated outbreaks at US basic training posts.[4,5]

In 1996, the sole manufacturer of adenovirus vaccines permanently ceased their production. Since then, there have been several adenovirus-associated outbreaks among military trainees.[3,6-8] The outbreak at Fort Benning underscores the medical and military operational consequences of losing the only specific countermeasure against the major cause of acute respiratory illness among trainees.

Poor ventilation and inadequate living space often have been cited as contributors to outbreaks of respiratory illnesses among military trainees.[9,10] In the case-control study of the Fort Benning outbreak, all cases slept in bays with nonfunctioning air handlers. Furthermore, although the affected unit complied with the Army standard of 72 square feet of floor space per soldier, there was a strong association between housing more than 50 soldiers per bay and the development of a febrile upper respiratory illness. Commanders and cadre should realize that poor ventilation and crowding in trainee barracks may facilitate the spread of respiratory pathogens which, in turn, increases rates of acute respiratory illnesses.

Finally, the Benning outbreak was not typical of adenovirus outbreaks among military trainees. The short duration and limited scope of the outbreak suggest that the affected battalion was epidemiologically isolated ("cohorted") from others in the training center. This finding suggests that strict unit cohorting may help to limit the durations, scopes, and magnitudes of future adenovirus outbreaks.

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Surveillance Trends

Completeness and Timeliness of Reporting of Hospitalized Notifiable Cases, US Army, January - December 1999

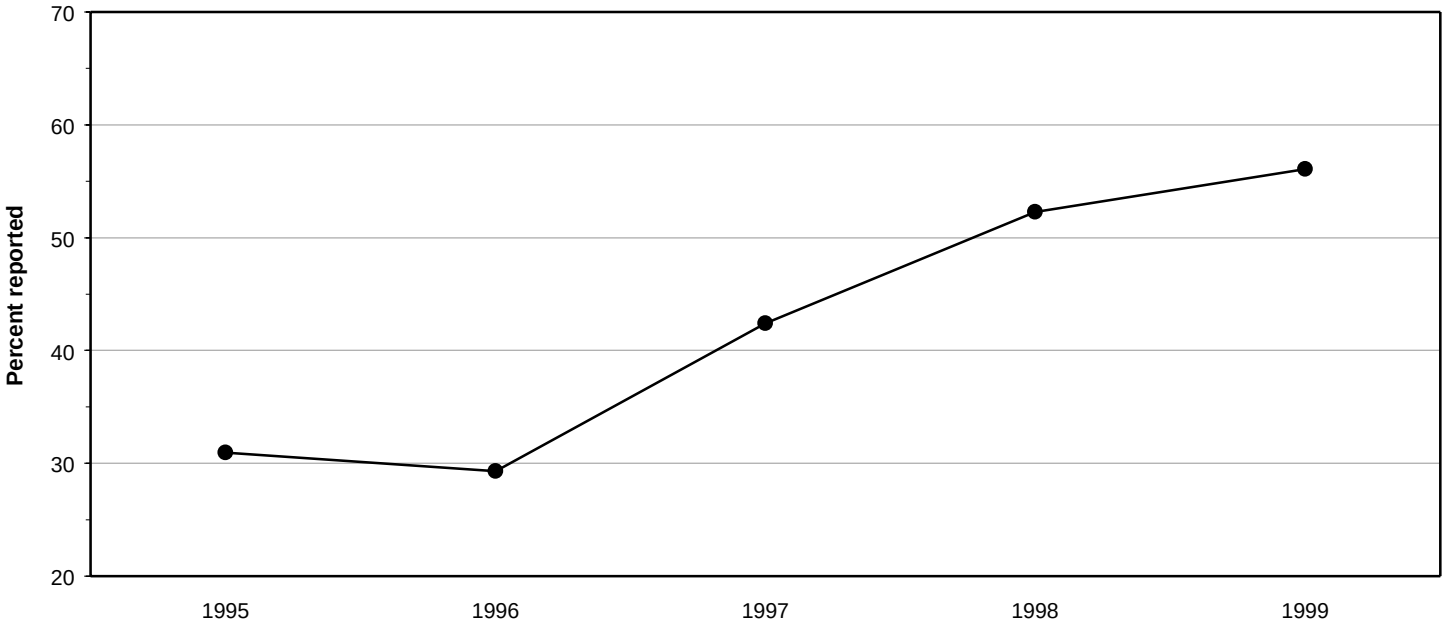
Automated reporting of notifiable conditions by the US Army began in 1994. In June 1998, the Office of the Army Surgeon General informed medical activity commanders of the requirement to report medical events specified in the triservice consensus list (*Tri-Service Reportable Events: Guidelines and Case Definitions, Version 1.0, July 1998*).[1] In November 1998, the Assistant Secretary of Defense for Health Affairs directed that consensus list be used by all the Service medical departments for medical events reporting and that the case reports of all Services be integrated in the Defense Medical Surveillance System (DMSS).[2] This report is the seventh semiannual assessment of Armywide reporting of hospitalized notifiable medical events among active duty soldiers.

Completeness of reporting, overall hospitalizations. There were 296 hospitalizations of active duty soldiers for conditions considered reportable (based on ICD-9-CM coded discharge diagnoses) for calendar year 1999. Of these, 166 (56%) were reported through the Army's Reportable Medical Events System (RMES). The completeness of reporting in 1999 exceeded that in 1998, continuing the long-term trend of increasing reporting completeness (figure 1).

Completeness of reporting, hospitalizations by diagnosis. The largest numbers of reportable hospitalizations were for heat injuries (n=126), varicella (n=63), and malaria (n=40). Percentages reported of these three diagnoses were 73%, 48%, and 70%, respectively (table 1, page 10).

Completeness of reporting, by site. There continued to be significant variability in reporting completeness across sites. Fort Rucker (100%),

Figure 1. Completeness of reporting reportable hospitalizations of active duty soldiers, 1995-1999



Fort Sill (100%), Tripler Army Medical Center (100%), Fort Bliss (86%), Fort Benning (74%) Fort Bragg (73%), and Fort Jackson (71%) had the highest reporting completeness rates for the period. There were 8 sites that reported more than half of their notifiable hospitalized cases during the period; however, there were 5 sites that reported less than 25% of their notifiable hospitalized cases. Only one post reported none of its cases (table 2, page 11).

Timeliness of reporting, hospitalized cases. Of hospitalized cases reported during 1999, 42% were reported within 1 week of hospital discharge and approximately 90% were reported within 1 month

Continued on page 12

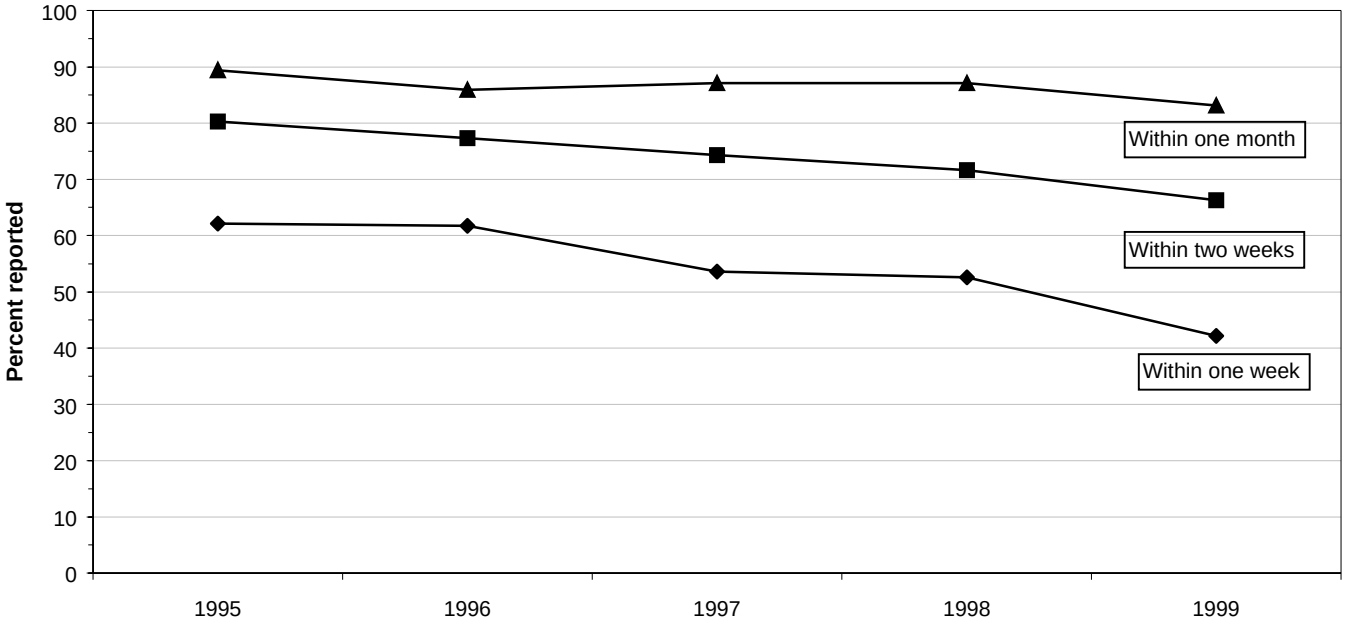
Table 1. Completeness of reporting, reportable hospitalizations, active duty soldiers, by diagnosis, 1997-1999

Reportable event	1997			1998			1999		
	Reported	Total	Percent	Reported	Total	Percent	Reported	Total	Percent
Amebiasis	-	-	-	0	1	0	0	1	0
Campylobacter infection	0	2	0	0	0	-	1	1	100
Carbon monoxide poisoning	0	7	0	4	11	36	0	0	-
Coccidioidomycosis	0	3	0	0	0	-	1	3	33
Cold weather injury	1	4	25	6	6	100	1	2	50
Dengue fever	-	-	-	1	1	100	1	1	100
Giardiasis	1	1	100	0	0	-	-	-	-
Gonorrhea	3	4	75	5	6	83	0	2	0
Heat	56	92	61	89	137	65	92	126	73
Hemorrhagic fever	-	-	-	-	-	-	0	2	0
Hepatitis A	1	5	20	2	3	67	0	3	0
Hepatitis B	2	6	33	2	4	50	3	7	43
Hepatitis C	0	3	0	0	2	0	0	1	0
Influenza	0	10	0	1	23	4	0	11	0
Leishmaniasis	17	30	57	1	2	50	0	0	-
Leprosy	1	3	33	0	0	-	0	0	-
Lyme disease	1	2	50	1	1	100	0	1	0
Malaria	27	32	84	26	30	87	28	40	70
Measles	-	-	-	0	1	0	-	-	-
Meningococcal disease	-	-	-	0	2	0	2	4	50
Pneumococcal pneumonia	0	17	0	0	16	0	4	14	-
Rheumatic fever, acute	-	-	-	0	1	0	-	-	-
Rocky Mountain Spotted fever	-	-	-	0	1	0	-	-	-
Rubella	-	-	-	0	0	-	-	-	-
Salmonellosis	6	15	40	3	12	25	2	8	25
Shigellosis	0	1	0	0	1	0	0	0	-
Syphilis	1	2	50	1	1	100	0	0	-
Tetanus	0	0	-	1	1	100	0	0	-
Tuberculosis, pulmonary	1	9	11	2	7	29	1	5	20
Tularemia	1	1	100	-	-	-	-	-	-
Urethritis, nongonococcal	-	-	-	-	-	-	0	1	0
Vaccine, adverse event	-	-	-	0	1	0	-	-	-
Varicella	60	173	35	49	100	49	30	63	48

Table 2. Reportable events and hospitalizations, active duty soldiers, by MTF, 1997-1999

MTF	1997			1998			1999		
	Number	Total	Percent	Number	Total	Percent	Number	Total	Percent
A	0	1	0	0	0	-	2	2	100
B	2	24	8	2	14	14	6	6	100
C	6	9	67	5	5	100	5	5	100
D	12	15	80	6	9	67	6	7	86
E	33	40	83	29	54	54	48	65	74
F	3	43	7	22	32	69	22	30	73
G	9	13	69	8	19	42	5	7	71
H	24	32	75	16	26	62	19	28	68
I	17	18	94	7	8	88	5	8	63
J	1	5	20	8	12	67	3	5	60
K	7	18	39	22	28	79	7	12	58
L	10	23	43	9	14	64	6	11	55
M	9	12	75	2	10	20	7	14	50
N	3	8	38	1	3	33	2	4	50
O	0	2	0	1	4	25	2	4	50
P	20	34	59	7	12	58	5	13	38
Q	2	14	14	2	5	40	3	8	38
R	1	7	14	19	21	90	2	6	33
S	0	8	0	2	17	12	3	11	27
T	0	4	0	2	4	50	2	9	22
U	0	5	0	3	5	60	1	5	20
V	9	50	18	12	41	29	4	25	16
W	9	23	39	9	21	43	1	7	14
X	1	12	8	0	6	0	0	4	0
Y	0	1	0	0	1	0	0	0	-

Figure 2. Timeliness of reporting reportable hospitalizations, active duty soldiers, 1995-1999



Continued from page 10
(figure 2, page 11). The timeliness of reporting during 1999 continued a gradual trend towards less timely reporting of hospitalized notifiable cases.

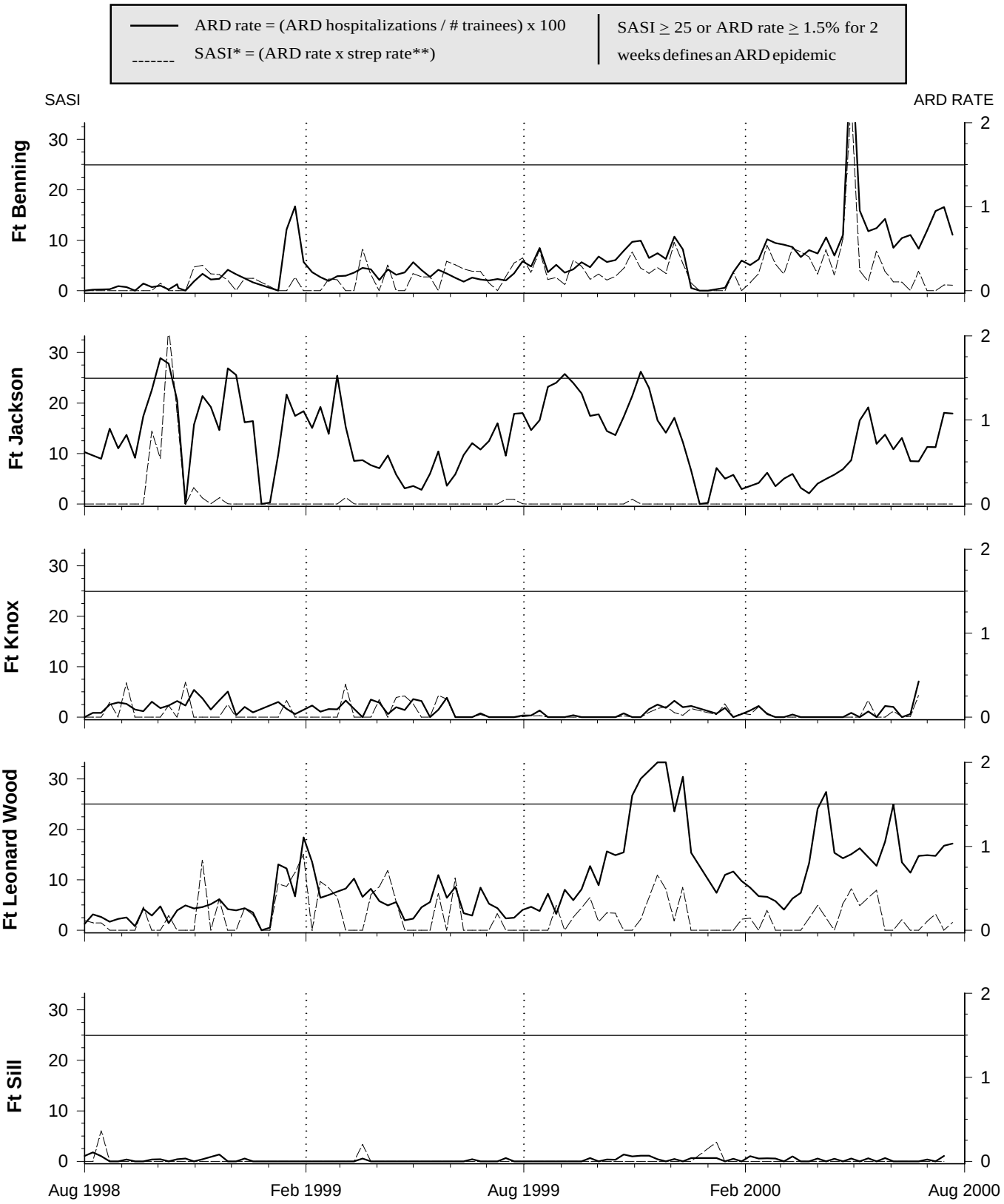
Editorial comment. For the past 3 years, AMSA has periodically compared reported cases of notifiable conditions with counterpart diagnoses reported through standard inpatient data systems. It is likely that estimates of completeness by this method underestimate actual reporting completeness since some ICD-9-CM codes are not specific for the reportable condition alone (i.e., they include clinical states that are not reportable) and diagnoses made in inpatient settings may not be based on criteria required for a confirmed reportable case . Nonetheless, notifiable disease reporting Armywide appears to be gradually and steadily improving.

Analysis by Robert Allen Frommelt, MS, Analysis Group, Army Medical Surveillance Activity.

References

1. Memorandum, HQ, US Army Medical Command, June 17, 1998, subject: Tri-service reportable events list.
2. Memorandum, Office of the Assistant Secretary of Defense (Health Affairs), November 6, 1998, subject: Tri-service reportable events document.

Figure II. Acute respiratory disease (ARD) surveillance update
US Army initial entry training centers



* SASI (Strep ARD Surveillance Index) is a reliable predictor of serious strep-related morbidity

** Strep rate = (Group A beta-hemolytic strep(+) / # cultures) x 100

Surveillance Trends

Migraines among Active Duty Military Personnel, 1998-1999

Migraine is a recurrent cranial vascular disorder that is a significant source of morbidity and temporary disability among young adults. During episodes of migraine, headaches can range in intensity from mild to severe, and debility can be minimal to complete. In turn, migraines often lead to missed workdays and the inability to meet job, social, and family responsibilities. Migraines may impair job task performance through visual disturbance, loss of balance, or spatial disorientation and, in the case of vital functions, can contribute to life threatening mistakes.[1] Finally, migraine sufferers consume enormous amounts of health care resources. According to the American Migraine Study, an estimated 23 million Americans suffer from severe headaches and migraines.[2] The National Ambulatory Medical Care Survey estimated that headaches account for nearly 4% of physician visits and more than 13% of uses of emergency and urgent care services.[3,4,5]

Studies have identified migraine risk groups based on age, gender, and socioeconomic status. There is relatively little information, however, regarding migraine risk in relation to occupations, particularly in military populations. Therefore, we examined the occurrence of migraines in active duty personnel and determined the proportion of those affected by migraines relative to their Department of Defense primary occupations.

Methods. The study population included all active duty servicemembers during the years 1998 and 1999. Standard Ambulatory Data Records of the Defense Medical Surveillance System were searched to identify all migraine-associated ambulatory visits during the study period. Table 1 lists the ICD-9-CM diagnostic codes that are used by military treatment facilities for migraine. For surveillance purposes, the case definition included servicemembers with at least one visit during the study period with a primary diagnosis of "migraine" (ICD-9-CM codes 346.0-346.9). Finally, migraine-associated visits that occurred more than 1 week apart were considered new episodes (rather than follow-ups)—and, thus, incident cases for rate calculations.

Results. During 1998 and 1999, among active duty servicemembers, 32,336 individuals reported incident migraine episodes. Among these individuals, 9,849 reported 2 or more epidsodes. The overall incidence rate during the period was 18.25 per 1,000 person-years. As expected from studies in other settings,[6] incidence rates varied in relation to gender and age. Most notably, the crude rate among females was approximately 5 times higher than among males (table 2); while rates increased with age in general, rates were significantly higher among females than males in every age group (figure 1).

Table 1. Migraine classification, International Classification of Diseases, 9th Revision, Clinical Modification

ICD-9 code	Description
346	**Migraine**
346.0	*Classical migraine*
	Includes migraine preceded or accompanied by transient focal neurological phenomena, migraine with aura
346.1	*Common migraine*
	Includes atypical migraine, sick headache
346.2	*Variants of migraine*
	Includes cluster headache, histamine cephalgia, Horton's neuralgia, migraine (abdominal, basilar), migraine (lower half, retinal), neuralgia (ciliary, migrainous)
346.8	*Other forms of migraine*
	Includes migraine (hemiplegic, ophthalmoplegic)
346.9	*Migraine, unspecified*

Table 2. Migraine frequency and rates, active duty servicemembers, US Armed Forces, 1998-1999

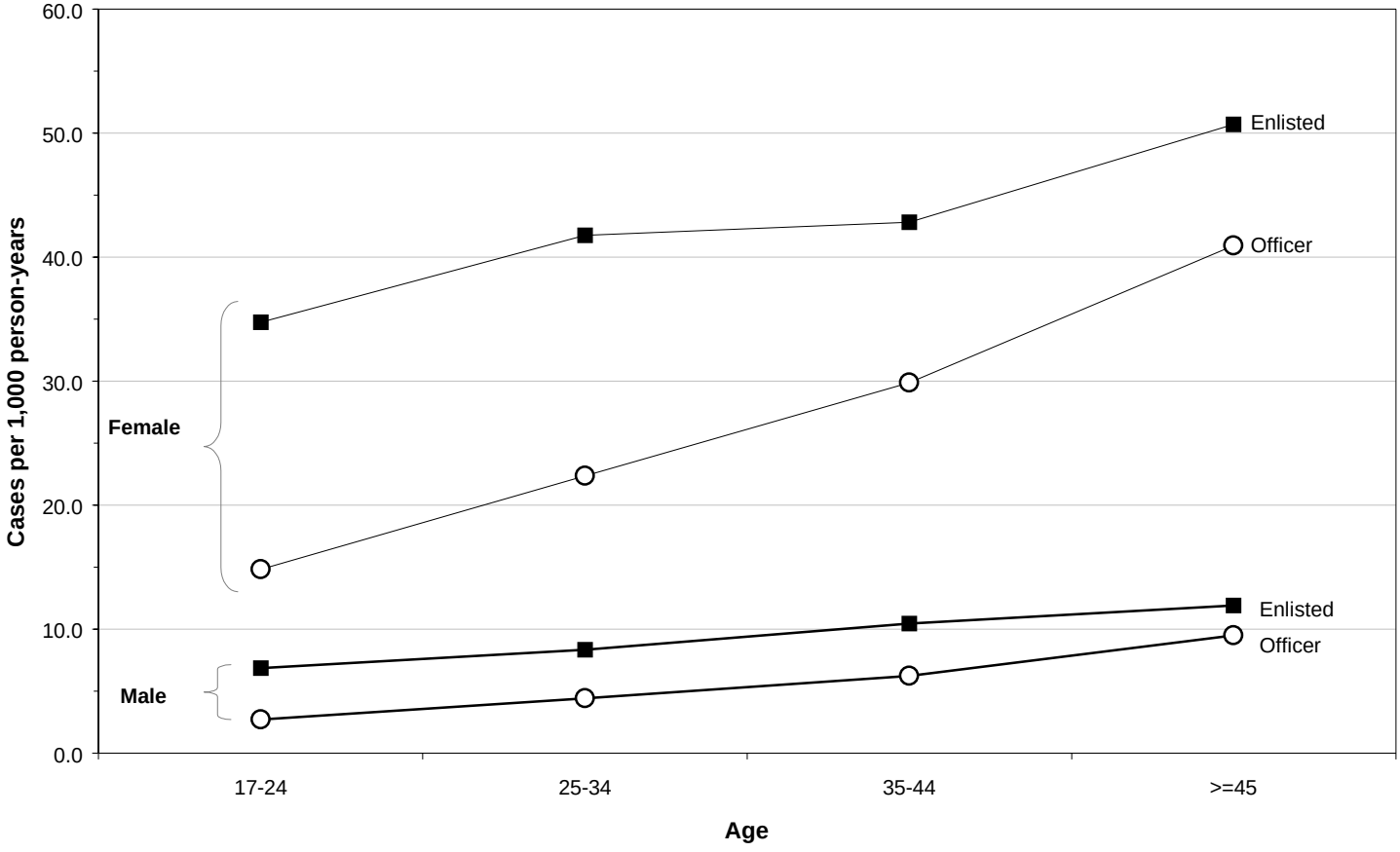
Characteristics	Cases	Rate per 1,000 person-years
Gender		
Female	14,089	36.45
Male	18,247	7.73
Age		
17-24	11,795	11.10
25-34	11,904	11.66
35-44	7,482	12.80
>=45	1,155	14.48
Status		
Enlisted	28,648	12.43
Officer	3,688	8.33
Service		
Air Force	11850	16.44
Army	11,094	11.74
Marines	2,046	5.98
Navy	7,328	9.9

Other studies have documented inverse relationships between household income and migraine risk.[2,6] To gain insights into socioeconomic effects, if any, in military populations, we compared migraine rates among officers and enlisted servicemembers. In every age and gender specific subgroup, migraine rates were higher among enlisted members than among officers (figure 1).

In relation to race/ethnicity, rates among black and white servicemembers slightly exceeded those among Hispanic and "other" racial-ethnic groups. (figure 2). Among those experiencing 2 or more episodes, rates were consistently higher among white and black females (data not shown). In relation to Service, rates were highest in the Air Force and lowest in the Marine Corps (figure 3).

Finally, crude rates of migraine were assessed in officer and enlisted occupational groups. Among

Figure 1. Migraine incidence rates, by age, gender, and military rank, US Armed Forces, 1998-1999



officers and enlisted personnel, health care workers had the highest rates, and the combat-specific occupational groups had the lowest (figure 4). For those with 2 or more episodes, functional support and administrative personnel had the highest rate; general officers and executives had the lowest (data not shown).

Editorial comment. This analysis documents the significance of migraines as sources of morbidity among active duty service members in general and among females in particular. In 1999, migraine was second among the top five ambulatory visit diagnoses among active duty females treated for nervous system disorders.[7] In this study, in nearly every subgroup examined, rates of migraine were 4 to 5 times higher among female servicemembers than their male counterparts. The results should encourage further investigations into the associated morbidities, health care costs, and military operational impacts of migraines in military populations, particularly females. In addition, modifiable "triggers" of migraine attacks in high risk demographic and occupation-specific subgroups should be identified and characterized.

Data analysis and report by Barbara Brynan, MPH, Analysis Group, Army Medical Surveillance Activity.

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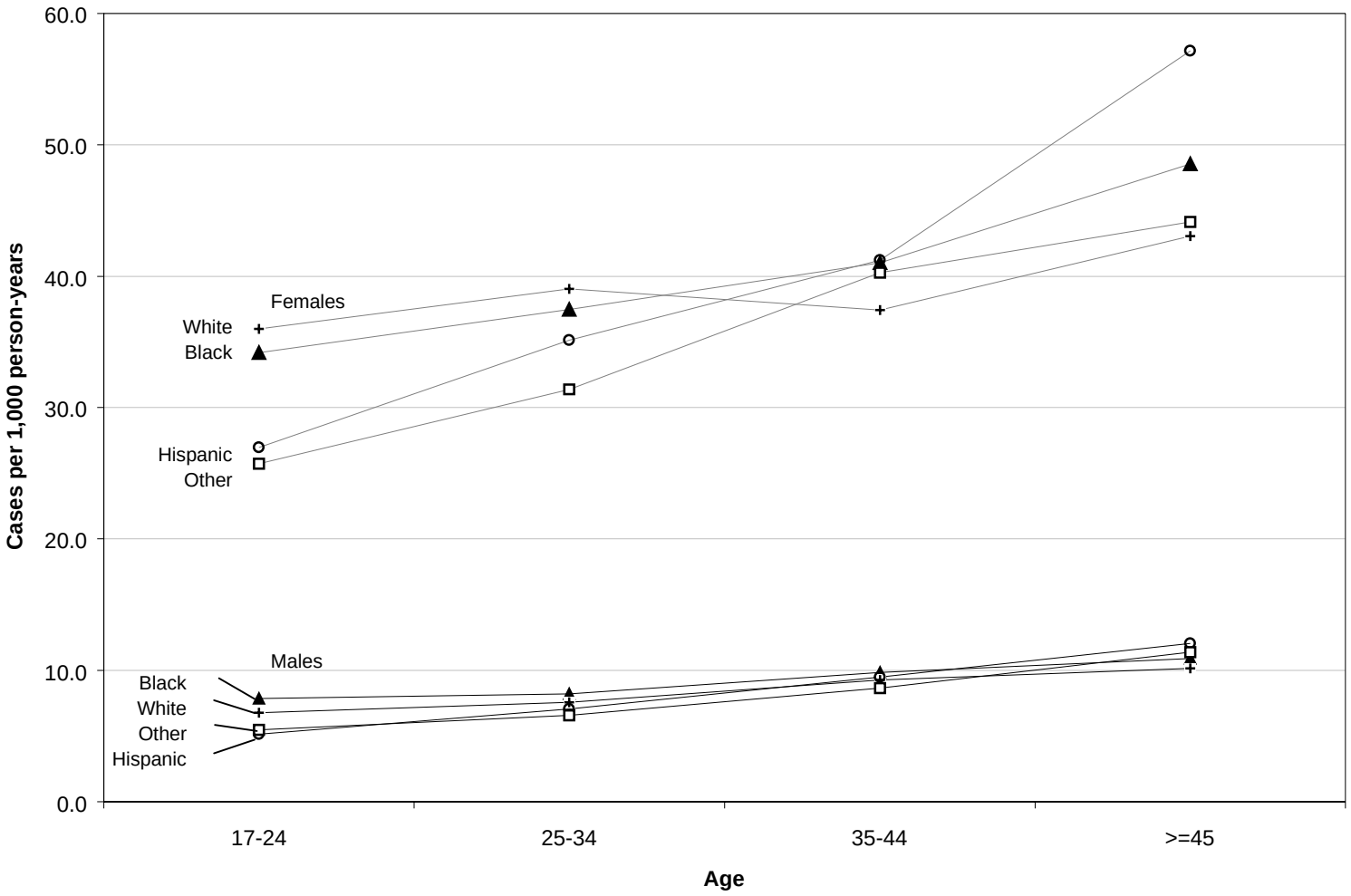
Figure 2. Migraine incidence rates, by race, ethnicity, and gender, US Armed Forces, 1998-1999



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7. USACHPPM. Summary of ambulatory visits, 1999. *MSMR.* 2000;6(4): 2-7.

Figure 3. Migraine incidence rates, by gender and service, US Armed Forces, 1998-1999

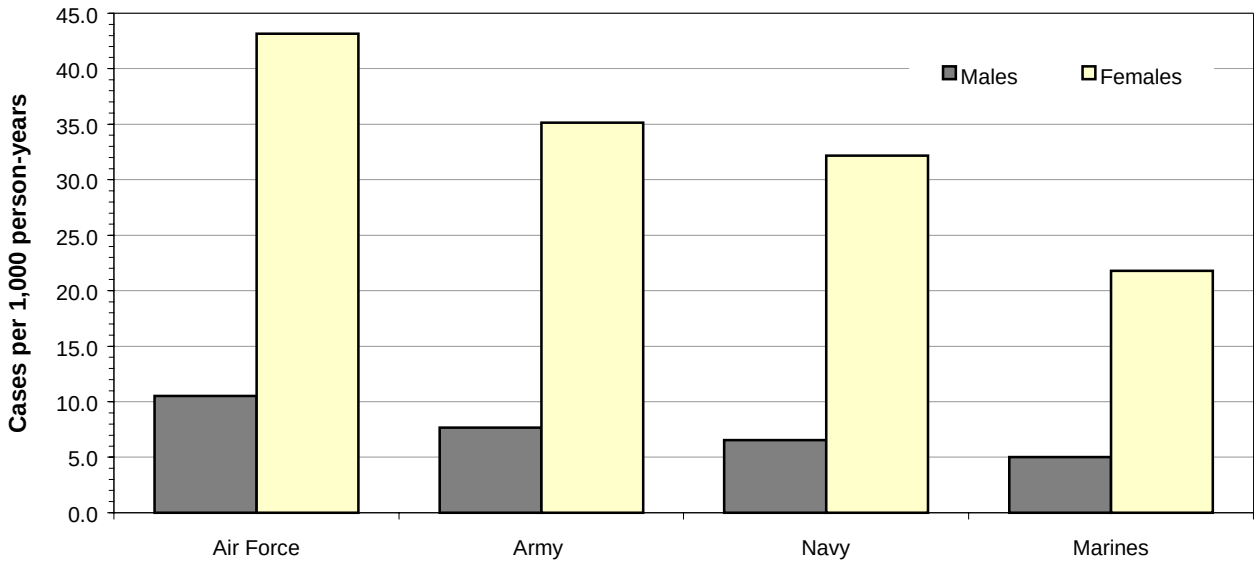
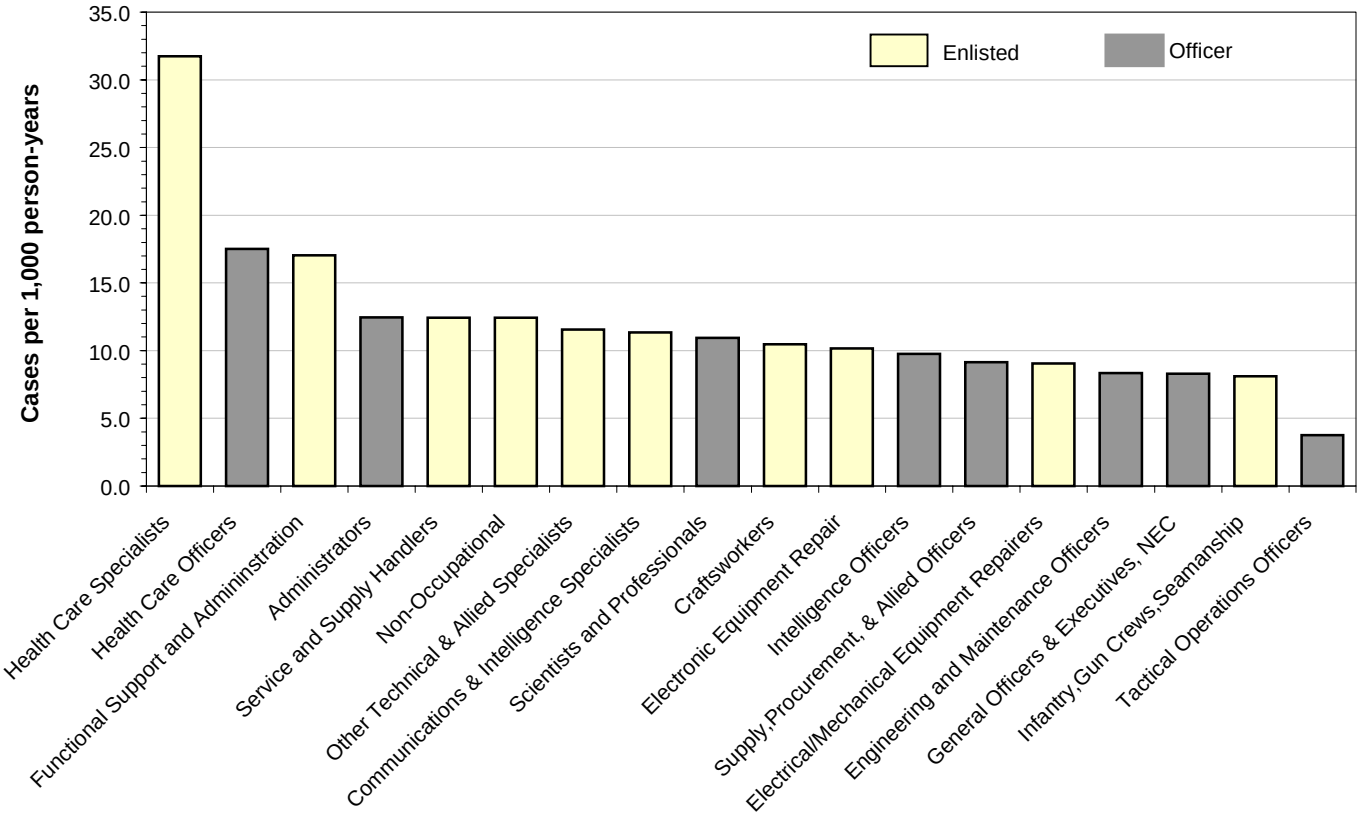


Figure 4. Migraine incidence rates, by officer and enlisted occupational groups, US Armed Forces, 1998-1999*



Supplement

Update: Human Immunodeficiency Virus, Type 1 (HIV-1), Antibody Screening Among Active and Reserve Component Soldiers and Civilian Applicants for Military Service, 1985 - June 2000

Since 1986, all members of the active and reserve components of the US Armed Forces have been periodically screened for antibodies to human immunodeficiency virus, type 1 (HIV-1). In addition, since October 1985, all civilian applicants for US military service have been screened for antibodies to HIV-1 during routine preinduction medical examinations at Military Entrance Processing Stations (MEPS). This report summarizes prevalences and trends of HIV-1 among routinely screened soldiers and civilian applicants for military service.

Methods. For active, reserve, and National Guard soldiers, newly detected cases of HIV-1 were included in rate calculations when records of first HIV-1 positive tests exactly matched identifying information on contemporaneous component-specific personnel files. For calendar-year-specific rate calculations, denominators were the sums of all soldiers in components of interest who were tested at least once during specified calendar years. Annual HIV-1 infection prevalences among civilian applicants for military service were calculated by dividing the number of applicants with first positive HIV-1 tests by the total number of applicants tested during specified calendar years.

Active duty soldiers. During 1999 and the first half of 2000, 57 active duty soldiers were newly diagnosed with HIV-1 infections during routine screening. There were fewer HIV-1 infections detected in 1999 than in any other year since routine testing began (table S1). The low prevalence of HIV-1 in 1999 (0.18 per 1000 tested) extends the long-term trend of slowly declining incidence (table S1). Of the 2,589 active duty soldiers diagnosed with HIV-1 infections since routine testing began, 278 (10.7%) remain on active duty (table S1).

Army Reserve. In 1999, twelve soldiers (9 males, 3 females) of the U.S. Army Reserve were diagnosed with HIV-1 infections during routine testing. The prevalence of HIV-1 in 1999 (0.33 per 1,000) continued the relative stability in rates of the preceding four years (figure S2).

Army National Guard. In 1999, 18 incident HIV-1 infections were detected among Army National Guard members during routine testing. The overall prevalence (0.22 per 1,000 tested) in 1999 extended the trend of relative stability since 1992 (figure S3). Of note, 1999 was the second year in a row in which no incident HIV-1 infections were diagnosed among female National Guard soldiers.

Civilian applicants for military service. Since October 1985, 4,480 civilian applicants for US military service have been diagnosed with HIV-1 infections during routine preinduction medical examinations. In 1999 and the first half of 2000, 148 applicants were detected with antibodies to HIV-1. The overall prevalence during the most recent 18-month period (0.31 per 1,000 tested) extended the approximately 5-year trend of relative stability. Prevalences among male and female applicants remained remarkably similar to each other and stable. The HIV-1 infection prevalence among black nonhispanic applicants continued to exceed the prevalences in other racial-ethnic subgroups (figure S5).

Table S1. Rates of new diagnoses of HIV-1 infections, Army active duty, 1985/86 - June 2000

Year	Total HIV tests received	Total persons tested	Males tested	Females tested	Total newly identified HIV positives	Newly identified HIV positive males	Newly identified HIV positive females	Total rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV positives currently on active duty
1985/86	390,645	365,740	327,181	38,559	927	883	44	2.53	2.70	1.14	14
1987	462,827	351,629	315,293	36,336	393	378	15	1.12	1.20	0.41	5
1988	446,922	381,102	334,989	46,113	195	188	7	0.51	0.56	0.15	3
1989	488,781	406,015	357,293	48,722	168	162	6	0.41	0.45	0.12	5
1990	533,675	440,852	385,614	55,238	153	144	9	0.35	0.37	0.16	8
1991	480,348	397,387	347,464	49,923	132	126	6	0.33	0.36	0.12	10
1992	530,957	427,707	374,319	53,388	125	117	8	0.29	0.31	0.15	18
1993	456,711	368,615	319,952	48,663	91	88	3	0.25	0.28	0.06	12
1994	417,944	341,348	294,151	47,197	80	75	5	0.23	0.25	0.11	19
1995	418,738	338,855	291,513	47,342	77	72	5	0.23	0.25	0.11	34
1996	373,634	307,114	261,470	45,644	67	61	6	0.22	0.23	0.13	31
1997	359,495	297,512	251,319	46,193	62	55	7	0.21	0.22	0.15	32
1998	361,120	295,210	248,039	47,171	62	54	8	0.21	0.22	0.17	39
1999	341,730	283,958	238,724	45,234	50	47	3	0.18	0.20	0.07	41
2000*	162,704	149,713	124,854	24,859	7	5	2	0.05	0.04	0.08	7
Total	**6,226,231**	**5,152,757**	**4,472,175**	**680,582**	**2,589**	**2,455**	**134**				**278**

*Data shown is through June 30, 2000.

Figure S1. Rates of new diagnoses of HIV-1 infections, active duty soldiers, US Army, 1990 - 1999

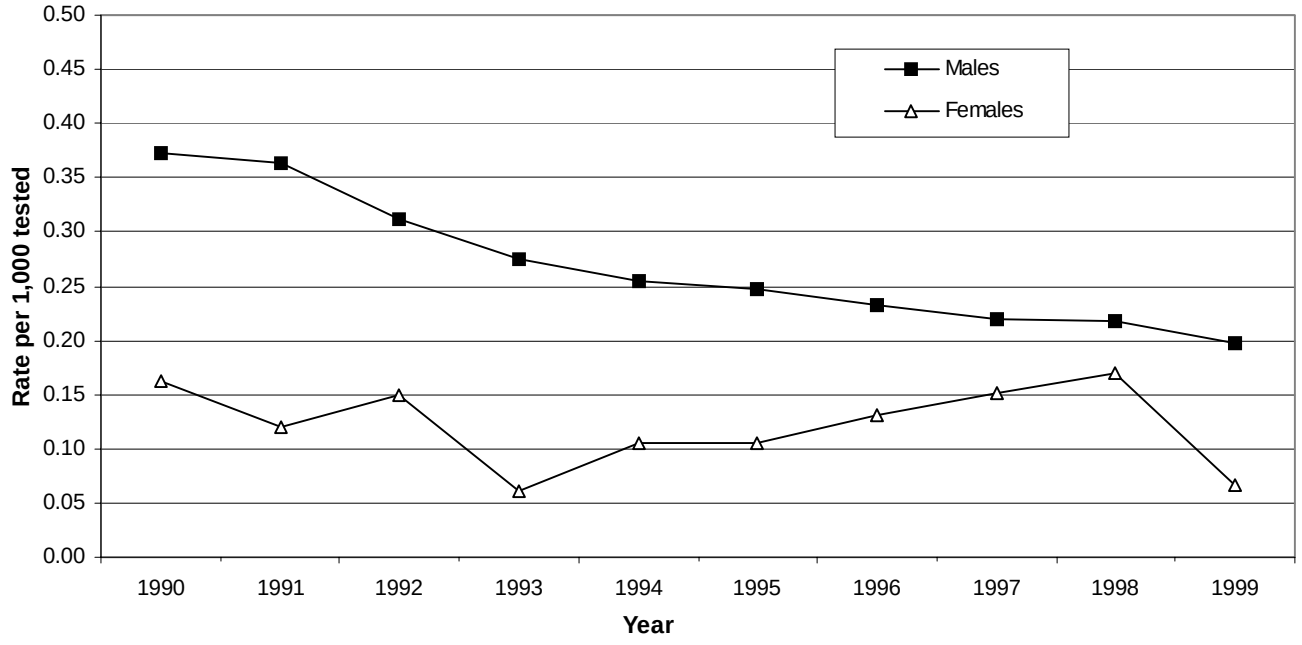


Table S2. Rates of new diagnoses of HIV-1 infections, Army Reserve, 1985/86 - June 2000

Year	Total HIV tests received	Total persons tested	Males tested	Females tested	Total newly identified HIV positives	Newly identified HIV positive males	Newly identified HIV positive females	Total rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV positives currently on active duty Reserve
1985/86	6,505	6,331	5,420	911	8	7	1	1.26	1.29	1.10	1
1987	158,183	147,787	120,516	27,271	35	33	2	0.24	0.27	0.07	1
1988	92,840	87,858	70,743	17,115	77	75	2	0.88	1.06	0.12	0
1989	172,260	158,242	127,450	30,792	81	76	5	0.51	0.60	0.16	1
1990	173,820	152,004	121,341	30,663	73	70	3	0.48	0.58	0.10	1
1991	121,033	110,242	87,964	22,278	61	59	2	0.55	0.67	0.09	0
1992	182,210	159,905	127,547	32,358	64	52	12	0.40	0.41	0.37	2
1993	146,302	130,104	103,888	26,216	42	38	4	0.32	0.37	0.15	1
1994	136,753	122,908	96,917	25,991	28	23	5	0.23	0.24	0.19	2
1995	104,688	95,676	75,475	20,201	29	23	6	0.30	0.30	0.30	2
1996	50,212	47,637	37,191	10,446	14	14	0	0.29	0.38	0.00	6
1997	43,783	41,721	31,731	9,990	15	13	2	0.36	0.41	0.20	4
1998	36,361	35,008	26,651	8,357	10	9	1	0.29	0.34	0.12	4
1999	38,881	36,426	27,707	8,719	13	9	3	0.36	0.32	0.34	12
2000*	19,759	18,828	14,215	4,613	0	0	0	0.00	0.00	0.00	0
Total	**1,483,590**	**1,350,677**	**1,074,756**	**275,921**	**550**	**501**	**48**				**37**

*Data shown is through June 30, 2000.

Figure S2. Rates of new diagnoses of HIV-1 infections, Army Reserve, 1990-1999

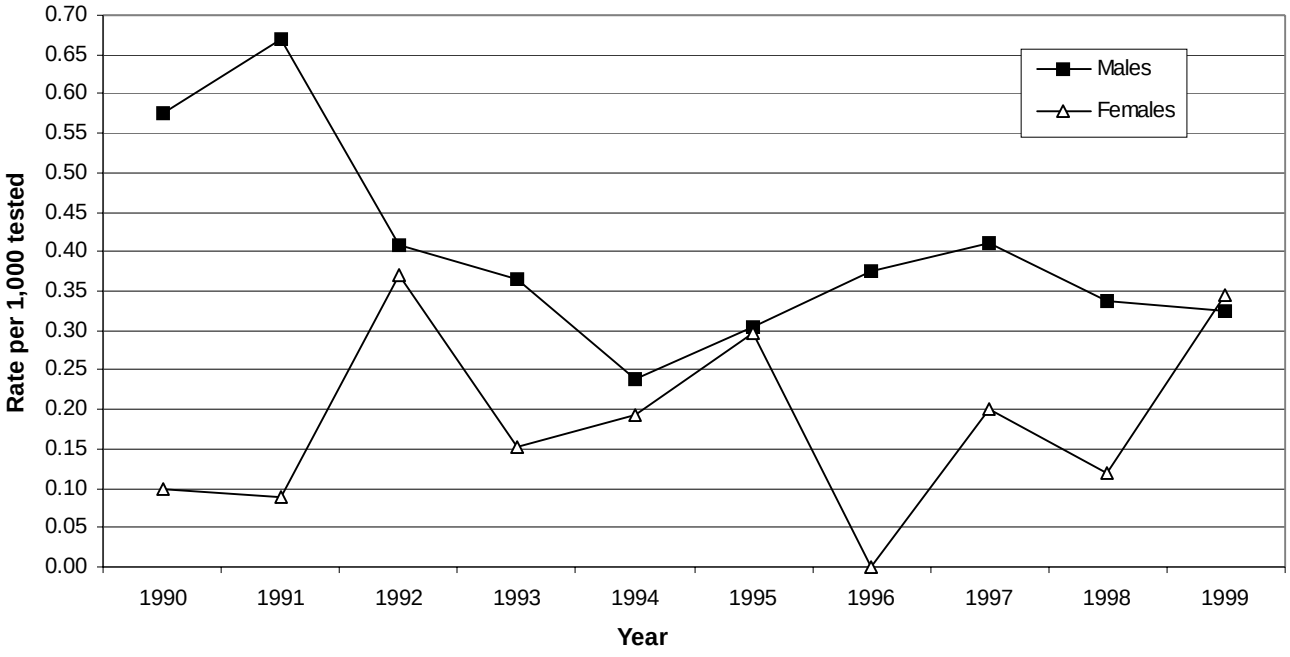


Table S3. Rates of new diagnoses of HIV-1 infections, Army National Guard, 1985/86 - June 2000

Year	Total HIV tests received	Total persons tested	Males tested	Females tested	Total newly identified HIV positives	Newly identified HIV positive males	Newly identified HIV positive females	Total rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV positives currently on active duty Guard
1985/86	97,087	95,921	90,990	4,931	32	30	2	0.33	0.33	0.41	1
1987	235,586	227,544	215,723	11,821	39	38	1	0.17	0.18	0.08	0
1988	163,497	157,696	148,332	9,364	51	47	4	0.32	0.32	0.43	6
1989	198,180	189,184	177,874	11,310	72	70	2	0.38	0.39	0.18	2
1990	229,622	213,242	198,186	15,056	66	64	2	0.31	0.32	0.13	0
1991	189,894	177,585	165,919	11,666	57	53	4	0.32	0.32	0.34	2
1992	251,539	236,038	218,743	17,295	56	54	2	0.24	0.25	0.12	0
1993	168,322	159,223	147,504	11,719	34	33	1	0.21	0.22	0.09	2
1994	199,906	186,971	172,257	14,714	38	35	3	0.20	0.20	0.20	5
1995	147,470	140,837	130,463	10,374	34	31	3	0.24	0.24	0.29	7
1996	61,627	58,831	53,968	4,863	19	18	1	0.32	0.33	0.21	2
1997	70,822	67,805	61,475	6,330	13	12	1	0.19	0.20	0.16	2
1998	78,056	74,934	67,917	7,017	17	17	0	0.23	0.25	0.00	8
1999	84,826	80,195	72,513	7,682	18	18	0	0.22	0.25	0.00	12
2000*	41,156	40,038	35,987	4,051	2	2	0	0.05	0.06	0.00	2
Total	**2,217,590**	**2,106,044**	**1,957,851**	**148,193**	**548**	**522**	**26**				**51**

*Data shown is through June 30, 2000.

Figure S3. Rates of new diagnoses of HIV-1 infections, Army National Guard, 1990-1999

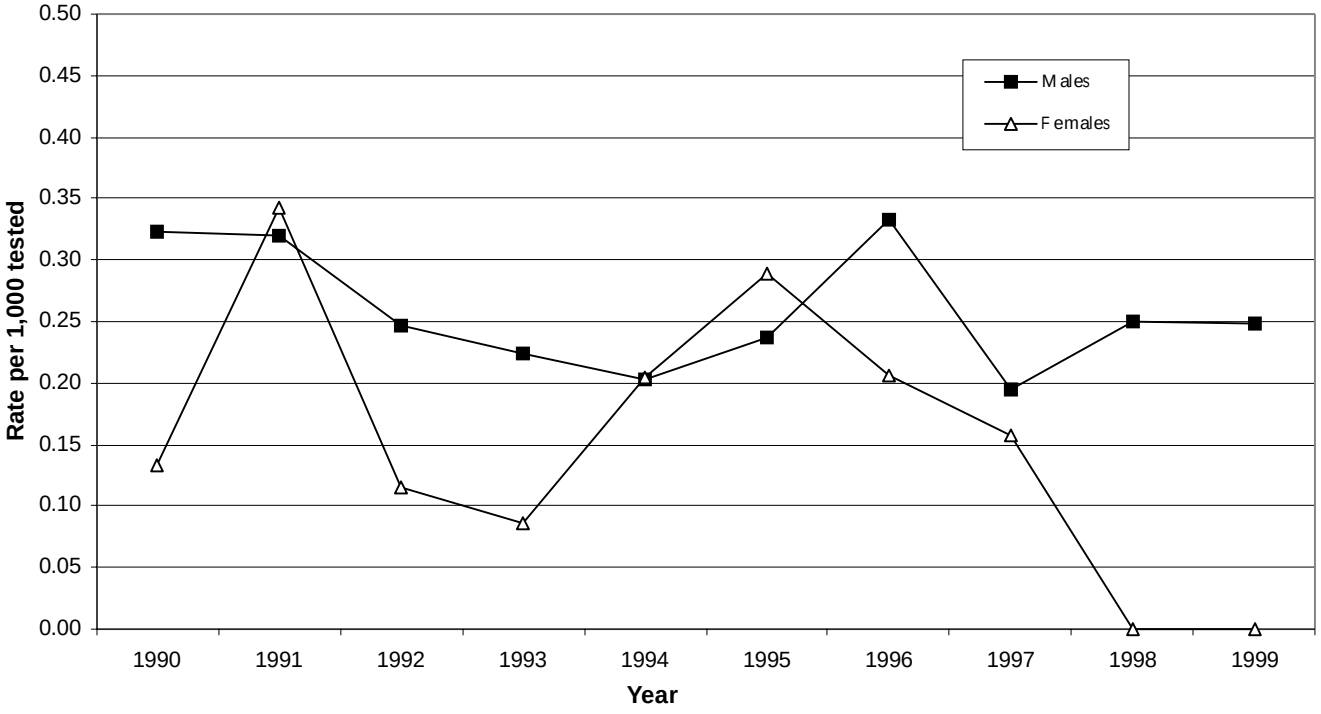


Figure S4. Prevalence of antibody to HIV-1, civilian applicants for US military service, by gender and year of screening, 1985/86 - June 2000

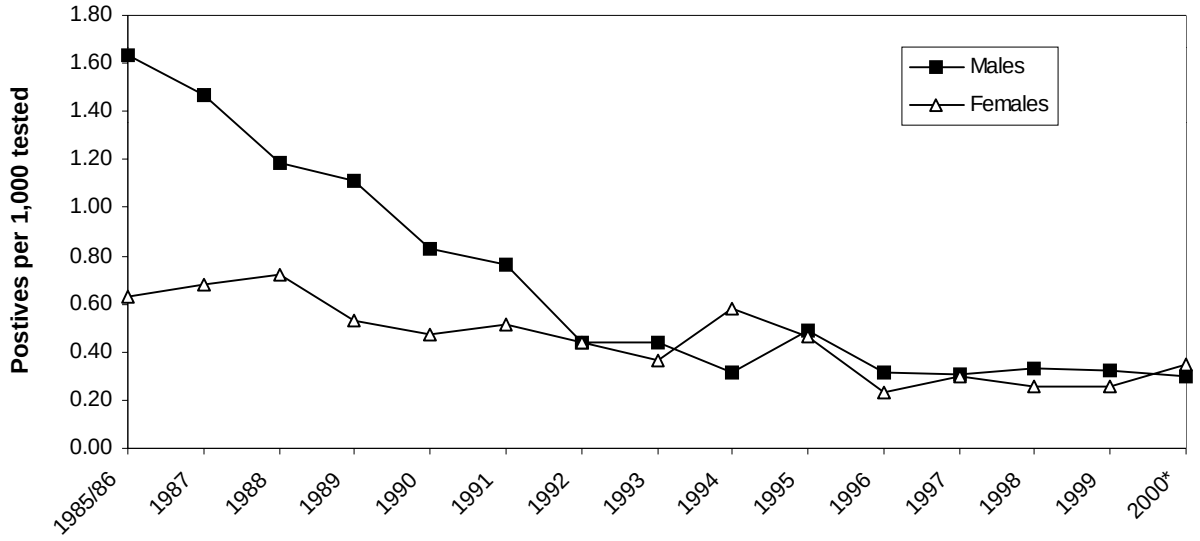


Figure S5. Prevalence of antibody to HIV-1, civilian applicants for US military service, by race, ethnicity, and year of screening, 1985/86 - June 2000

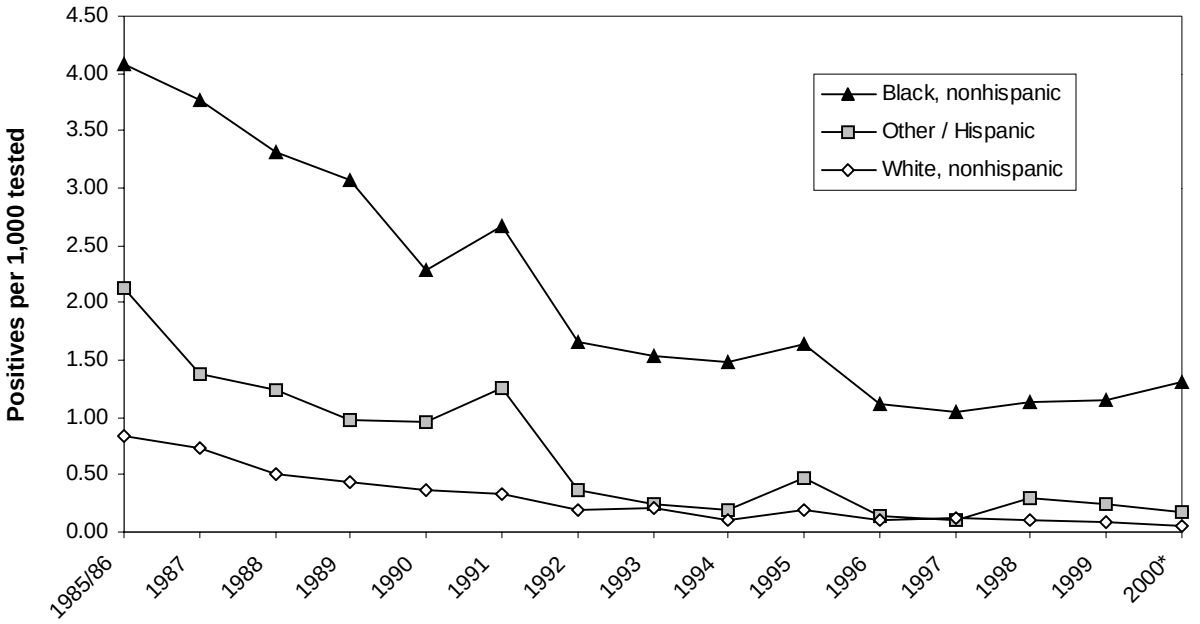


Table S4. HIV-1 tests, US Army Active Duty, Reserve, and National Guard, 1999

Test purpose	Active duty	Reserve	National Guard	Total
Clinical / STD	17,776	622	995	19,393
Force testing	244,602	29,314	41,534	315,450
Physical exam	41,403	8,086	41,129	90,618
Other / Unknown	37,949	859	1,168	39,976
Total tests	**341,730**	**38,881**	**84,826**	**465,437**
Total persons tested	283,958	36,426	80,195	400,579
Number positive	50	12	18	80
Prevalence per 1,000	0.18	0.33	0.22	0.20

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